After the 4th question in the document, please proceed with the following tasks in order to build models and estimate the parameters so far.

Fill in the table with the results you took by hanging weights with limited motion part.

PWM (%)	Direction	Measured Current (A)	Measured Weight that handled (g)	Measured Torque (Nm)	V_{cfb} (V)
0					
10					
15					
20					
25					
30					

By applying linear approximation (curve fitting) for different values of PWM percentage, determine the following models.

a) Model for determining torque constant (K_t)

$$K_t i = \tau_m$$

b) Model for determining relation between the current feedback voltage (V_{cfb}) and the actual current in order to be used in microcontroller

$$i = a_1 V_{cfb} + a_2$$

Fill in the table below, when the free rotation is applied.

PWM (%)	Armature Voltage (V_a)	Measured Encoder Frequency (Hz)	Determined Rotational Velocity (rad/s)	Measured Current (A)	Measured Terminal Filter Voltage (V_{filter})	Estimated Terminal Voltage $(V_a - V_b = KV_{filter})$ (K →voltage divider coef)
10						
20						
30						
40						
50						
60						
70						
80						

By applying linear approximation (curve fitting) for different values of PWM percentage, determine the following models.

c) First model for determining back-emf constant (K_b)

$$\frac{V_a}{I} = K_b \frac{\omega}{I} + R$$

d) Second model for determining back-emf constant (K_b)

$$V_a = K_b\omega + KV_{filter}$$

e) Model for determining friction coefficient (B)

$$K_t i = B\omega$$

f) Model for determining relation between the velocity feedback voltage (V_{filter}) and the motor velocity (ω) in order to be used in microcontroller

$$\omega = \frac{V_a - KV_{filter}}{K_b}$$